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Improved Process of Fabricating Ferrite Cores for Magnetic Logic Circuits

The characteristics of ferrite core structures achieved in processing are affected by parameters such as starting composition and green density of the material, mixing procedure, firing and calcining temperatures, firing time, and rates of heating and cooling. In particular, magnetic cores used in certain unique logic circuits are required to have partially saturated-state properties. These magnetic cores are required to function in a partially saturated set state as well as in the fully saturated set and clear states. Cores produced by conventional processes have too low a threshold in the partially saturated state. As a result, drives which are applied for affecting certain cores will also affect cores which should be left in their partially set state.

A simple, reliable method of processing magnetic ferrite structures has been devised to enhance their partially set-state properties, so that the threshold magnetomotive force required to produce a specified change of flux is increased. Compositions that can be processed to obtain the desired characteristics are within the boundaries for the square loop compositions of the $\text{MgO-MnO-Fe}_2\text{O}_3$ ferrite system. The ferrites may be formed directly from the metal oxides or from decomposable precursor compounds, such as carbonates, peroxides, or oxalates, which furnish the oxides. The ferrite materials may also contain oxides of Cd, Zn, Th, or Ca. The compositions can be formed from either a pressing powder or a castable slurry into a green ferrite core or structure ready for final firing. A summary of the new critical features of the process follows.

The green ferrite cores are inserted into a tube furnace in which a controlled-flow atmosphere (air or oxygen) is maintained. These cores may be inserted into the furnace at or near soak temperature, or at ambient temperature. They are then heated to soak temperature (1200° to 1350°C) at a rate ranging from 100° to 500°C per hour. The soak temperature, controlled within 5°C , is held for 2 to 20 hours to obtain the desired threshold and partial-set-state properties. Soaking at lower temperatures results in too high a threshold, while soaking at higher temperatures lowers the threshold. Final cooling of the cores is conducted in nitrogen or other inert gas. Superior cores are produced by (1) insertion of the green ferrite cores at room temperature and heating in flowing oxygen or air at a rate of 200°C per hour to a soak temperature between 1270° and 1290°C , (2) maintaining this temperature for 4 hours, (3) cooling (preferably at 200°C per hour) in oxygen or air to a temperature 25° to 125°C below soak temperature, (4) introducing nitrogen and continuing the cooling at the same rate to below the Curie temperature of the ferrite composition.

Notes:

1. Purity of the starting materials must be closely controlled.
2. Requests for further information may be directed to:

Technology Utilization Officer
Langley Research Center
Hampton, Virginia 23365
Reference: TSP70-10104

(continued overleaf)

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)), to the Ampex Corporation, 401 Broadway, Redwood City, California 94063.

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